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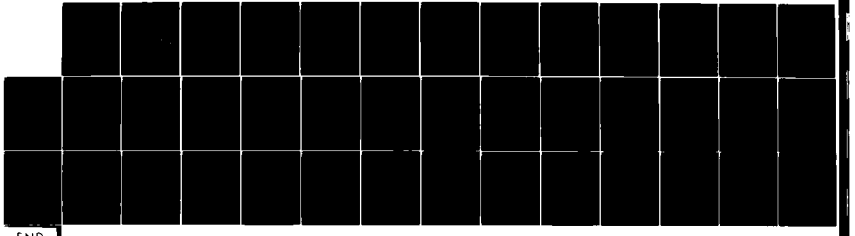

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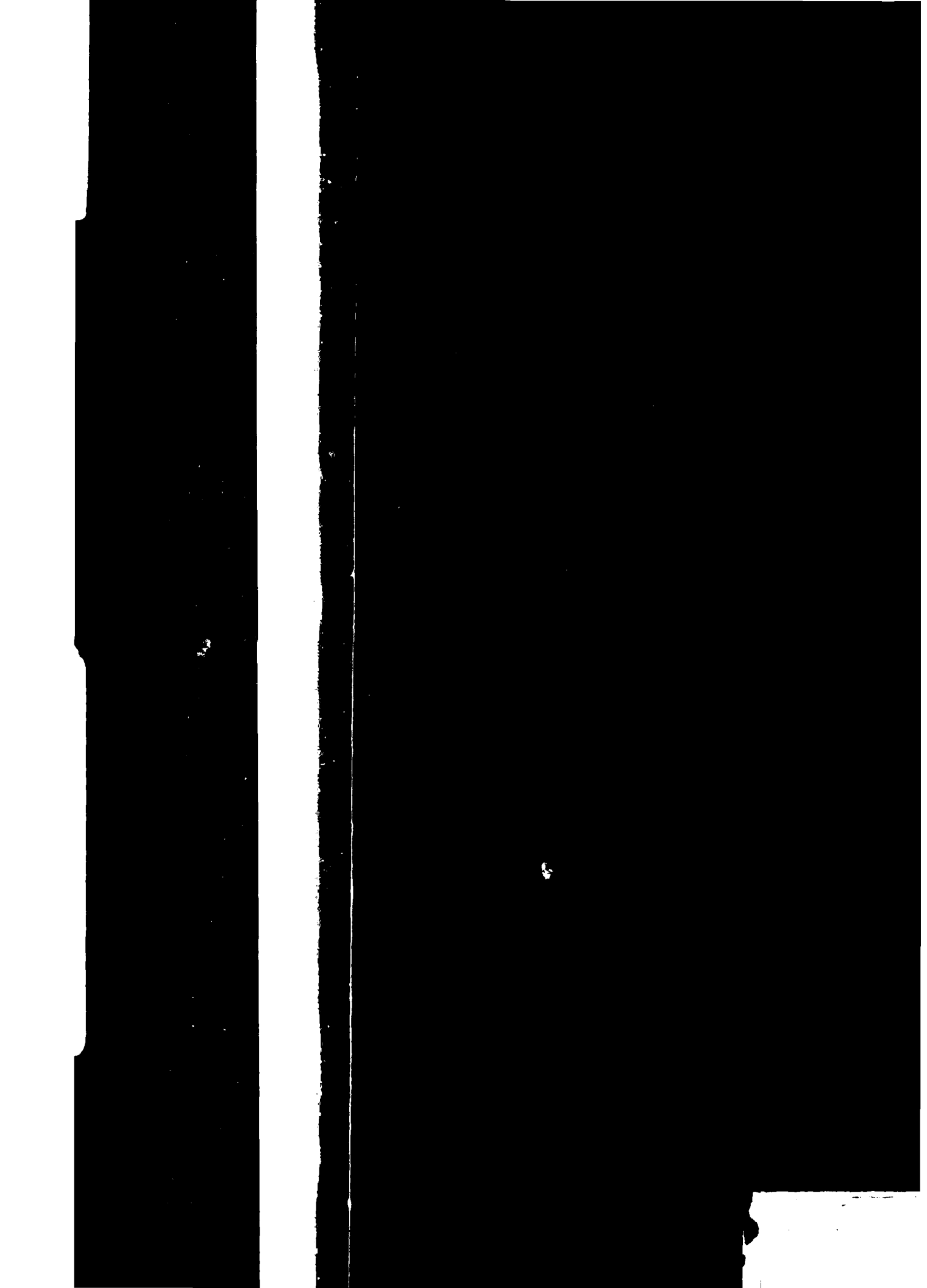

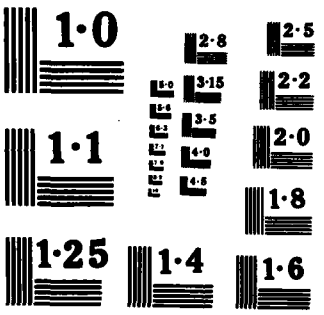
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(2)

VALIDATION OF THE ALGORITHM FOR BASE DIRECT MATERIAL COST FOR THE COMPONENT SUPPORT COST SYSTEM (D160B)

Contract No. F33600-82-C-0543

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Submitted to:

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EXECUTIVE SUMMARY

Visibility and Management of Operating and Support Costs is a program initiated by the Office of the Secretary of Defense (OSD) in order to ensure that each Military Department gathers, tracks, and computes operating and support costs by weapon system. VAMOSC II is an Air Force management information system which is responsive to the OSD initiative. It uses information from existing Air Force data systems to satisfy both Air Force and OSD needs for certain weapon system operating and support (O&S) costs.

At present, the VAMOSC II system comprises three subsystems:

(1) The Weapon System Support Cost (WSSC) system (D160), which deals with aircraft,

(2) The Communications - Electronics (C-E) system (D160A), which deals with ground communications - electronics equipment,

(3) The Component Support Cost Subsystem (CSCS) (D160B), which deals with subsystems and components for aircraft.

The Component Support Cost System (CSCS) of VAMOSC II gathers and computes support costs by assembly/subassembly and relates those costs back to the end item or weapon system. CSCS replaces the Logistic Support Cost (LSC) model of K051 (AFLCR 400-49) for aircraft and engines.

The CSCS receives inputs from 15 Air Force data systems. On a quarterly basis, the system provides two standard reports each processing cycle and twelve other types of reports as requested by users. It also provides pre-programmed data base extracts on magnetic tape on a one-time basis in response to user requests.

Special requests for data in user selected format may also be satisfied on a case by case basis.

At the heart of the CSCS is a set of 30 algorithms for estimation or allocation of costs. Information Spectrum, Inc. (ISI) was awarded a contract to validate these algorithms. This effort included investigations of logic, appropriateness of the algorithms and assumptions inherent in the algorithms. ISI was also to survey published findings, reports of audit, etc. relating to the accuracy of the source data systems. In addition to the algorithm validation, ISI was to perform certain "special tasks," including a user survey.

This report provides the verification and validation of the algorithm called "Base Direct Material Costs." It addresses the costs of consumable material issued by base supply organizations to maintenance shops for repairs of aircraft.

Supply organizations of the Air Force maintain records in terms of National Stock Number, not Work Unit Code. In order to assign the costs of the material to subsystems and components, an allocation procedure was needed. This algorithm allocates costs in proportion to the number of repair actions reported.

In order to verify and validate the CSCS algorithms, a set of analysis procedures applicable to all of the algorithms was established. These procedures were than applied to each algorithm. This report first describes the analysis procedures, without reference to the specific algorithm addressed by this report.

Next, the Direct Material Cost algorithm is defined and described in detail. This description includes identification source data systems and files, and the calculation procedures currently implemented by the CSCS.

Finally, a critique of the algorithm is provided as required by the contract. It addresses the following topics:

- Verification of assumptions and approximations for appropriateness and accuracy.
- Validation of accuracy of source data.
- Validation of appropriateness of source data as inputs to CSCS logic.
- Investigation of accuracy and appropriateness of algorithms.
- Consideration of replacement of indirect cost methods with more direct ones.
- Identification of algorithm impact on CSCS output reports.

For each algorithm addressed, ISI is required to affirm the process or procedure and reject any portion that cannot be affirmed. Where the algorithm or portion of the algorithm is rejected, an alternate procedure must be specified.

No defects in the Base Material Cost algorithm could be found. It is recommended that it be retained in its present form.

Also, as a result of our investigations, personnel of the Air Force Data System Design Center identified a programming error in a system providing inputs to this algorithm. The impact of this error is small. It should be easy to correct, and a recommendation to this effect is provided.

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1.0 INTRODUCTION

Visibility and Management of Operating and Support Costs is a program initiated by the Office of the Secretary of Defense (OSD) in order to ensure that each Military Department gathers, tracks, and computes operating and support costs by weapon system (all costs are computed and portrayed in "then year" dollars). VAMOSC II is an Air Force management information system which is responsive to the OSD initiative. It uses information from existing Air Force systems to satisfy both Air Force and OSD needs for certain weapon system operating and support (O&S) costs.

At present, the VAMOSC II system comprises three subsystems:

(1) The Weapon System Support Cost (WSSC) system (D160), which deals with aircraft,

(2) The Communications - Electronics (C-E) system (D160A), which deals with ground communications - electronics equipment,

(3) The Component Support Cost Subsystem (CSCS) (D160B), which deals with subsystems and components for aircraft.

1.1 The Component Support Cost System

The Component Support Cost System (CSCS) of VAMOSC II gathers and computes support costs by assembly/subassembly and relates those costs back to the end item or weapon system. CSCS replaces the Logistic Support Cost (LSC) model of K051 (AFLCR 400-49) for aircraft and engines.

The objectives of the Component Support Cost System are:

(1) To improve the visibility of aircraft and engine component support costs and to relate those costs to the end item or weapon system.

(2) To improve the Life Cycle Costing capability for the Air Force and the Department of Defense in the acquisition of new weapon systems.

(3) To assist in the design of new weapon systems by providing cost information on components for existing weapon systems thereby enhancing design tradeoff studies.

(4) To provide historical cost information at the subsystem and component level to improve logistic policy decisions.

(5) To identify system component reliability, effectiveness, and costs so that high support cost items may be identified and addressed.

The CSCS is described in detail in references [1], [2], and [3]. It receives inputs from 14 Air Force data systems. On a quarterly basis, the system provides two mandatory reports each processing cycle and twelve other types of reports as requested by users. It also provides pre-programmed data base extracts on magnetic tape on a one-time basis in response to user requests. Special requests for data in user selected format may also be satisfied on a case by case basis.

The twelve reports maintained above are of primary interest to the user community. They are identified by name in Table 1. Descriptions and samples are provided by reference [1].

TABLE 1. CSCS OUTPUT REPORTS

NUMBER*	Name
8105	Cost Factors
8104	MDS Logistics Support Costs
8106	Base Work Unit Code (WUC) Costs
8107	Total Base Work Unit Code (WUC) Costs
8111	Depot On-Equipment Work Unit Code (WUC) Costs
8108	Total Base and Depot Work Unit Code (WUC) Costs
8109	NSN-MDS-WUC Cross-Reference
8110	MDS-WUC-NSN Cross-Reference
8112	Logistic Support Cost Ranking, Selected Items
8113	Summary of Cost Elements
8114	NSN-WUC Logistics Support Costs
8115	Assembly-Subassembly WUC Costs

*CSCS output reports are assigned Report control Symbol HAF-LEY (AR)nnnn, where nnnn is the number in the table.

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algorithms are identified by
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bases.
ts at the level of the five
Air Force data systems
but not material costs. The
d Reporting Designator (SRD)
is issued. In some cases the
identified. The algorithm
s to the five digit level on
tions reported.

TABLE 2. CSCS

1. Base TCTO Labor Cost
2. Base TCTO Overhead Cost
3. Base TCTO Material Cost
4. TCTO Transportation Cos
5. Base Inspection Costs
6. Base Other Support Gene
7. Base Labor Costs
8. Base Direct Material Co
9. Base Maintenance Overhe
10. Second Destination Tran
11. Second Destination Tran
12. Base Exchangeable Repai
13. Base Exchangeable Repai
14. Base Exchangeable Modif
15. Base Condemnation Spare
16. Base Exchangeable Modif
17. Base Supply Management
18. Depot TCTO Labor Costs
19. Depot TCTO Material Cos
20. Depot TCTO Other Costs
21. Depot Support General C
22. Depot Labor Costs
23. Depot Direct Material C
24. Depot Other Costs
25. Depot Exchangeable Repa
26. Depot Exchangeable Repa
27. Depot Exchangeable Modi
28. Depot Exchangeable Modi
29. Depot Condemnation Spar
30. Depot Material Manageme

2.0 ANALYSIS PROCEDURES

In order to verify and validate the CSCS algorithms, a set of analysis procedures applicable to all of the algorithms was established. These procedures were then applied to each algorithm. This section describes the analysis procedures without reference to the specific algorithm addressed by this report.

The algorithm analysis process consists of six portions, described in the following sections.

2.1 Algorithm Description

The algorithms are described in references [1], [2], and [3]. These descriptions are not identical. In general they supplement, rather than contradict each other. The first two describe what the system is to achieve; the third describes the system design to do so.

None of these descriptions provides the combination of level of detail and clarity of concept required for this validation effort. The first step in the analysis methodology was the generation of such a description. The descriptions in the three reference sources just cited were studied. Assumptions about data processing procedures were made explicit. When necessary, Air Force personnel involved in implementation of the D160B subsystem were contacted for clarification.

2.2 Input Data Definitions

Closely related to the first step was the clarification of the definitions of the input data. The identification of each

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input data element and of the system providing it was provided by the User's Manual (reference [1]). This identification was refined by identification of a particular file within the source system and the structure of the file as described in both the CSCS System/Subsystem Specification and in the Memoranda of Agreement. The Memoranda of Agreement have been established between the Office of VAMOSC and the Offices of Primary Responsibility (OPR) for the systems providing the input data. Any inconsistencies or voids were identified and resolved through contact with the Office of VAMOSC and/or implementing personnel.

Whenever appropriate, input data element definitions were further refined by tracing the elements back to their sources through the reference data provided. If these were inadequate, the OPRs were contacted directly for clarifications. In tracing the data back to their origins, possible sources of data contamination were considered. Information on the likelihood and significance of such contamination was collected from cognizant personnel and from published references.

2.3 Concept Validation

The two steps above established exactly what the algorithm does. The third, and most critical step, considered the validity of the procedure. It depended on the ability of the analyst to translate mathematical formulas and data processing techniques into meaningful concepts.

Some explicit techniques which were generally used in concept validation for all algorithms are listed below.

(a) Consider how the cost element would be calculated if

there were no constraints on resources. (For example, suppose the CSCS could identify the pay grade and hours worked of each individual involved in a maintenance action.)

(b) Identify assumptions* incorporated into the Algorithm. Generally this procedure will identify the real constraints which affect the approach in (a) above.

(c) Identify approximations incorporated into the algorithm. For instance, one such approximation is the use of an average labor rate for each aircraft.

(d) Study each approximation for possible sources of error. Some examples are biases introduced by editing procedures, obsolete data, or inappropriate application. Whenever feasible, estimate the likelihood of these errors by reviews of the literature and contact with cognizant personnel.

(e) Test the algorithms under conditions of assumed extreme values for the inputs. For instance, in evaluating the algorithm for base maintenance overhead costs, assume that for a single reporting period all maintenance labor is overhead and none is direct. Also try the

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*Note that assumptions, approximations, and allocations are different concepts, although in some cases the boundaries between them are not sharp. ISI has recognized few assumptions in the algorithms, but many approximations and allocations.

reverse assumption. If an assumption of an extreme input leads to an illogical result, the algorithm is flawed.

Task 4 of Section C-2 of the contract speaks of appropriate statistical techniques to confirm or repudiate each algorithm. Statistical techniques could confirm or repudiate only statistical hypotheses as assumptions. (Use of an average does not constitute an assumption.) Accordingly, statistical techniques apply to confirmation or repudiation of an algorithm only to the extent that statistical hypotheses can be developed.

(f) As each algorithm is considered, ensure that the costs do not overlap others already accounted for. (In some cases an overlap may be necessary and desirable. Where this occurs, the overlap will be noted.)

(g) In each CSCS output report, identify the data elements incorporating the output of the algorithm, so that a final assessment of report accuracy can be made for each output report.

(h) Consider alternative sources of input data for the algorithm. Also consider more direct cost assignments then those incorporated in the algorithm.

2.4 Problem Resolution

Whenever a significant deficiency was recognized in one of the algorithms, one or more proposed solutions were developed. This was a creative analytic process for which few guidelines

could be proposed in advance. Certainly it depended on familiarity with the various existing Air Force data reporting and processing systems. Proposed solutions were discussed with personnel of the Office of VAMOSC, and revised as appropriate. Recommended solutions were expressed in the form of contributions to a draft Data Automation Requirement (DAR) when these would be applicable.

2.5 Documentation

The documentation of the analysis of each algorithm was a crucial part of the effort. Emphasis was placed on making it thorough, clear, and unambiguous. In the documentation, every assertion was substantiated. This was done by reference to source documentation, by explicitly expressed application of the experience and judgment of the contractor, or by citation of information provided by cognizant Air Force personnel. In the last case, the information was supported by documentation identifying the source, the date, and the information provided.

3.0 ALGORITHM ANALYSIS

The previous section described the general analysis procedures applied to all algorithms. This section presents the results of applying those procedures to the algorithm for Base Direct Material Costs.

Section 3.1 Provides a detailed description of the algorithm and of the input data it uses. Section 3.2 provides a critique, structured to correspond to the contractual requirements. Section 4.0 makes recommendations for solutions of problems.

3.1 Algorithm Description

In the following description COBOL-type data names are used to express the algorithm output and its components. The available source documentation does not provide the actual data names used by the CSCS programs. They are presumably different from those used in this report.

This description provides a formula for the calculation that is derived from the Users Manual and other sources. It is not the same as the formula provided in the Users Manual. It is intended to be more explicit. The formula is stated in Section 3.1.1. The input data elements and their sources are provided in Section 3.1.2. The calculation is described verbally in Section 3.1.3. Unless otherwise noted, the descriptions are based on references [1], [2], and [3], and on direct discussion with personnel of the Office of VAMOSC. In case of any discrepancies, information provided by knowledgeable personnel was accepted as most current, hence most definitive.

3.1.1 Calculations

In this report the calculations are explained with intermediate steps displaying the aggregation of counts of repair actions.

(a) MDS-BASE-WUC-REP-ACTS = MDS-BASE-WUC-ACTS-ON
+ MDS-BASE-WUC-REP-ACTS-OFF.

(b) MDS-BASE-SYS-REP-ACTS = $\sum_s$ MDS-BASE-WUC-REP-ACTS,

where $\sum_s$ denotes summation over all repair action reports for the designated system.

(c) MDS-BASE-SRD-REP-ACTS = $\sum$ MDS-BASE-SYS-REP-ACTS,

where $\sum$ denotes summation over all systems for the entire aircraft.

(d) MDS-BASE-WUC-MAT-COST

$$= \text{MDS-BASE-SYS-MAT-COST} \times \frac{\text{MDS-BASE-WUC-REP-ACTS}}{\text{MDS-BASE-SYS-REP-ACTS}}$$

$$+ \text{MDS-BASE-SRD-MAT-COST} \times \frac{\text{MDS-BASE-WUC-REP-ACTS}}{\text{MDS-BASE-SRD-REP-ACTS}}$$

3.1.2 Inputs

Name: MDS-BASE-WUC-REP-ACTS-ON

Definition: Number of on-equipment repair action reports for the calendar quarter, base, MDS, and five digit Work Unit Code.

Source System/File: D056A/MNI70K0

Name: MDS-BASE-WUC-REP-ACTS-OFF

Definition: Number of off-equipment repair actions reports for the calendar quarter, base MDS, and five digit Work Unit Code.

Source System/File: D056C/MPI15K0

NAME: MDS-BASE-SYS-MAT-COST

Definition: Total of currently listed prices for all material issued at the base for the calendar quarter for the MDS (identified by SRD) and system (identified by two digit WUC).

Source System/File: D002A/(1)

Name: MDS-BASE-SRD-MAT-COST

Definition: Total of currently listed prices for all material issued at the base for the calendar quarter for MDS (identified by SRD) but lacking identification for the system to which it applies.

Source System/File: D002A/(1)

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(1) "Base Consumable material" file (no number).

3.1.3 Description of Calculation Procedure

As indicated in Section 3.1.2, on equipment actions and off-equipment actions are passed to the CSCS monthly by two different parts of D056. In step (a) of Section 3.1.1, the on-equipment and off-equipment repair action counts are needed for each individual Work Unit Code (system) on the aircraft. The sum of the five digit repair action counts is calculated in step (b). These counts are added for all systems on the aircraft in step (c), yielding a total count for the aircraft.

From the Automated Material System interfaced with the Supply System at Base Level (D002A), the CSCS receives monthly reports of all material issued for the MDS and base. Some of these reports identify the system to which the material applies, and others do not. The reports include the current price for each issued item. The CSCS accumulates the prices for the quarter for each system when one is identified, and for the whole aircraft when one is not.

Step (d) of Section 3.1.1 achieves the allocation of material costs to the five digit Work Unit Codes. A single Work Unit Code is assigned a portion of the system material costs for the system to which it belongs, as well as a portion of the "whole aircraft" costs. One way to look at calculation (d) is that system material costs are divided by the number of system repair actions, yielding average system material costs per repair action. Also, "whole aircraft" material costs are divided by total repair actions, yielding average "whole aircraft" material costs per repair action. Then, for each Work Unit Code, the number of repair

actions for the quarter is multiplied by the sum of both kinds of costs. This explanation corresponds to rewriting formula (d) as

$$\text{(d)}\quad \text{MDS-BASE-WUC-MAT-COST} = \left(\frac{\text{MDS-BASE-SYS-MAT-COST}}{\text{MDS-BASE-SYS-REP-ACTS}} + \frac{\text{MDS-BASE-SRD-MAT-COST}}{\text{MDS-BASE-SRD-REP-ACTS}}\right) \times \text{MDS-BASE-WUC-REP-ACTS}$$

3.2 Critique of Algorithm

This section addresses various facets of the algorithm. The discussion is structured to correspond to the contractual requirements. Each aspect is either affirmed or rejected. Rejections lead to recommendations in Section 4.0.

3.2.1 Appropriateness and Accuracy of Assumptions and Approximations

The algorithm is based on one approximation: that the costs of materials used in repairs is proportional to the number of maintenance actions. This approximation is invoked to allocate costs to the five digit Work Unit Codes from the two digit or whole aircraft level, depending on which way they are reported.

Informal discussions with Air Force personnel show that it is generally believed that in most cases a maintenance event yields a single maintenance action. A "maintenance event" technically corresponds to the assignment of a job control number. Intuitively, a maintenance event corresponds to a response to an apparent malfunction at either the organizational or intermediate level.

Since materials issues are not identified with five digit Work Unit Codes by current reporting systems, some allocating scheme is certainly needed. ISI can identify three possible methodologies for allocation based on the following proxies: number of maintenance actions, number of maintenance events, or maintenance man-hours. We can find no basis for preferring either of the two to the number of maintenance actions. Accordingly, we affirm the appropriateness of this choice.

As for accuracy, it is easy to see that the sum of the values given by formula (d) of Section 3.1.2 for all Work Unit Codes on one aircraft MDS is the sum of all costs provided by D002A for that MDS. Hence the allocations are exclusive and exhaustive of the material costs. Together with appropriateness, this is all we can ask of an allocation procedure. Exact values are not a criterion, since if they were available, no approximation would be needed. ISI affirms the accuracy of the approximation as well as its appropriateness.

3.2.2 Accuracy of Source Data and Congruence of Data Element Definitions

Information Spectrum was directed to validate accuracy of source data based on a survey of published findings, reports of audit, etc. No direct sampling of data was to be performed. The Office of VAMOSC has indicated that direct validation of source data is planned for future efforts

This algorithm receives data from two systems: the Product Performance System (D056) and the Automated Material System

Interfaced with Supply Systems at Base Level (D002A). No published criticism of the accuracy of the latter could be found, and ISI affirms its accuracy. The accuracy of the D056 system has been criticized, notably in reference [11]. The criticisms are reviewed in reference [17]. That reference also points out that a new maintenance data collection system under development, the Automated Maintenance System (AMS), holds considerable promise of improvement.

In any event, the impact of any inaccuracies in the D056 system in this algorithm is lessened because of the way the data from that system is used. In this algorithm, the D056 data is the basis for the allocation procedure. Absolute errors in the D056 reports have no effect on the algorithm. There are adverse effects only to the extent that maintenance actions are under (or over) reported for one Work Unit Code, or for one system, as compared with others, at a single base and for a single MDS. It is reasonable to expect that any such biases should be much smaller than the absolute errors in man-hour reporting. Information Spectrum believes that the impact of D056 data errors on the Base Direct Material Cost algorithm is not significant.

The "congruence of data element definitions" considers whether the source data elements really mean what the CSCS algorithm implicitly "thinks" they mean. This question requires some detailed discussions.

3.2.2.1 Material Costs

Material costs are extracted by D002A from a file called the Transaction History File. This file has a record for every supply transaction. "Transactions" encompass a wide range of activities, including issues, turn-ins, receipts, shipments, and a variety of adjustments. The CSCS is interested only in issues. On some occasions material is turned into supply from maintenance; the CSCS is concerned with net issues.

Issues and turn-ins include many transactions of no concern to the CSCS. In order to reduce unnecessary storage and processing of irrelevant information, D002A uses record selection criteria to choose records to be passed to the CSCS. The criteria are reproduced in Attachment 1, copied from reference [24]. These criteria evolved from methods used for other purposes. The rationale behind them is not documented. Information Spectrum is satisfied, on the basis of its study of the criteria, that the selection criteria do not cause exclusion of any records the CSCS would want.

However, as a result of our investigations, an error in procedure by D002A was discovered. The error was acknowledged in reference [24], which identified it as follows:

> "Local manufacture transactions (TRIC "REC" with FIA 440) are assumed to be issues by the program instead of a turn-in. The end result is a local manufacture receipt and an issue can cause iden-

tical contributions to the Daily CSCS Record (lCM)."

Instead of subtracting local manufacture receipts from Issues, D002A is adding them. This error has little impact, since local manufacture (by intermediate maintenance shops) is uncommon, and tends to apply to low-priced items.

Also of interest are the unit prices used by D002A. Reference [24] states that prices are updated through the Stock Number User Directory (D071), Contract (Local Purchase) Price Changes, or manually prepared entries. D071 gets the price updates from D043, the Master Item Identification Control System (reference [25], Chapter 9, Section 21). D043 gets its updates from the Item Managers at the ALCs (reference [26], Chapter 35). Discussions with Air Force personnel indicate that Item Managers update prices when they purchase new items for the inventory, but may also update as they think appropriate.

It may be argued that the ideal unit price for the CSCS is the price at which the issued item was purchased, or the current cost of replacing it. (The latter is not well defined, because it depends on the quantity purchased.) The price being used may be described as the current "catalog price." Information Spectrum considers this definition, as good as, or better than, the alternatives. It is desirable, however that system users be informed of the meaning of the price.

3.2.2.2 Number of Repair Actions

Repair actions are initially documented on AFTO Form 349,

3.2.4 Accuracy and Appropriateness of the Algorithm

It has already been noted that material costs are not directly linked to the five digit Work Unit Codes by existing reporting systems. Accordingly, some approximation is necessary. Section 3.2.1 showed that the allocation scheme does account for all material costs, and associates these with five digit Work Unit Codes in a reasonable way. ISI affirms the accuracy and appropriateness of the algorithm.

3.2.5 Directness of Costing

By incorporating material transactions as reported at their source, the algorithm accounts for transactions as directly as possible. The conversion of transactions to costs in terms of current catalog prices is discussed in Section 3.2.2.1; this approach may be described as direct as well. Accordingly, we affirm the directness of costing in this algorithm.

3.2.6 Application to CSCS Output Reports

Direct material costs are components of CSCS reports as described by Table 3. The accuracy of the algorithm output will impact the accuracy of the reports as a whole. However, the total report accuracy cannot be addressed until all algorithms are reviewed. This will occur in the final report of this effort. Evaluation of the usefulness of the report will also be provided in the final report of this effort and after ISI conducts a survey of users.

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TABLE 3

CONTRIBUTION OF BASE DIRECT MATERIAL COSTS ALGORITHM TO CSCS OUTPUT REPORTS

OUTPUT REPORT (1)	COST ELEMENTS CONTRIBUTED TO BY THE ALGORITHM (2)
1. MDS Logistic Support Costs/8104	1. By MDS for all Bases: a. WUC Component Costs (1) Base b. Total MDS Costs c. (Two digit) WUC Cost
2. Base Work Unit Code (WUC) Cost/8106	2. By MDS and Bases: a. Total Base Costs, Component b. (Five digit) WUC Direct Material Costs c. (Five digit) Total WUC Costs
3. Total Base Work Unit Code (WUC) Costs/8107	3. By MDS for all Bases: a. Total Base Costs, Component b. (Five digit) WUC Direct Material Costs c. (Five digit) Total WUC Costs
4. Total Base and Depot Work Unit Code (WUC) Costs/8108	4. By MDS for all Bases: a. Total Costs, Component b. (Five digit) Base Direct Material Costs c. Base and Depot (Five digit) WUC Total
5. Summary of Cost Elements/8113	5. By MDS for all Bases: a. Unit Level Consumption Direct Material Costs

(1) CSCS output reports are assigned Report Control Symbol HAF-LEY (AR) nnnn, where nnnn is the number indicated in the output report title in Table 3.

(2) Identified by the title printed in the report.

4.0 RECOMMENDATIONS

Section 3 has presented ISI's judgement that the algorithm for Base Direct Material Cost is valid. Every aspect of the algorithm was affirmed, and we recommend that it be retained in its present form.

Section 3.2.2.1 described a programming error in the D002A system(1) discovered by personnel of the Air Force Data Systems Design Center as a result of investigations by Information Spectrum. Section 4.1 presents a recommendation to correct the error.

4.0a Office of VAMOSC (OOV) Comments

Concur

4.1 Correction to D002A

It is recommended the programming error in D002A be corrected. Appropriate DAR entries are provided in attachment 2.

4.1a Office of VAMOSC (OOV) Comments

Concur. The DAR will be submitted in conjunction with a request for additional organization codes needed by the C-E system. OOV will submit the DAR by 29 Feb 1984.

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(1) In fact there were two errors discovered. The other one is addressed in reference [34].

REFERENCES

[1] AF Regulation 400-31, Volume IV (6 August 1982), Visibility and Management of Operating and Support Cost Program (VAMOSC) Component Support Cost System (CSCS)

[2] FD-K-14010C, Functional Description (for the Component Support Cost System (CSCS), Data System Designator D160B, undated draft)

[3] SS-K-15010B, Component Support Cost System/Subsystem Specification, 1 June 1983

[4] TO-00-20-2, Technical Manual: The Maintenance Data Collection System, 1 November 1981

[5] TO-00-20-2-45-2, Operational Supplement to Technical Order: Maintenance Documentation for In-Shop Engine Maintenance, 1 October 1982

[6] Memoranda of Agreement (listed separately)

[7] Letter from Chief, Material, Cost & International Accounting Systems Division, Directorate of Plans & System, HQ USAF, dated 27 Feb 1981, Subject: Direct Labor Rates

[8] Air Force Magazine, May 1983 (Almanac Issue)

[9] AFLC Pamphlet 173-10, AFLC Cost and Planning Factors, 31 December 1981

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[11] "The Air Force Can Improve Its Maintenance Information System," U.S. General Accounting Office Report No. GAO/GGD-83-20, 25 January 1983

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[16] HQ USAF/ACF (AFAFC) Denver, Co ltr (undated), Subject: Direct Labor Rates for VAMOSC (your 21 Apr 83 ltr)

[17] "Validation of the Algorithm for Base TCTO Labor Cost for the Component Support System (D160B)," Information Spectrum, Inc., Report No. V-83-31859-01, 15 August 1983

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[20] AF Manual 177-370, USAF Standard Base-Level Accounting and Finance System (B3500), 1 December 1979

[21] TO-00-20-2-2, Technical Manual: On-Equipment Maintenance Documentation for Aircraft; Air-Launched Missiles; Ground-Launched Missiles; Except ICBMS; Drones; and Related Training Equipment, 1 August 1976, updated to 15 October 1982

[22] TO-00-20-2-10, Technical Manual: Off-Equipment Maintenance Documentation for Shopwork, Conventional Munitions, and Precision Measuring Equipment, 1 January 1978, updated to 1 August 1982

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[24] Letter from Chief, Material Systems Division, Directorate of Comptroller Systems, Air Force Data Systems Design Center, to HQ AFLC/MM(VAMOSC), dated 15 September 1983, Subject: "D002A, Daily Consumable Material Cost Data Interface with D160B, Component Support Cost System (CSCS) (your ltr, 15 Aug 83)."

[25] AF Manual 67-1, USAF Supply Manual, Vol. II, Part I, Base Procedures, updated to 18 April 1983

[26] AFLC Regulation 72-2, Cataloging and Standardization, 3 March 1980, updated to 29 May 1982

[27] "Validation of the Algorithm for Base TCTO Overhead Costs for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-83-31859-02, 15 August 1983

[28] "Validation of the Algorithm for Base Labor Costs for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-83-31859-06, 13 December 1983

[29] DoD Handbook 7220.29-H, Department of Defense Depot Maintenance and Maintenance Support Cost Accounting and Production Handbook, updated through 13 September 1979

[30] AF Manual 400-1, Volume II, Comprehensive Engine Management System (D042) Engine Status, Configuration and TCTO Reporting Procedures, 1 October 1983

[31] "Validation of the Algorithms for Base Exchangeable Repair Costs (Engine) and Base Exchangeable Modification Costs (Engine) for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-84-31859-10, 11 February 1984

[32] TO-00-5-15, Technical Manual: Air Force Time Compliance Technical Order System, 15 April 1983

[33] "Validation of the Algorithm for Depot TCTO Labor Costs for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-84-31859-12, 12 April 1984

[34] "Validation of the Algorithm for Depot TCTO Material Costs for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-84-31859-13, 12 April 1984

[35] "Validation of the Algorithm for Depot TCTO Other Costs for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-84-31859-14, 12 April 1984

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[42] VAMOSC Operating Instruction 7, Component Support System (CSCS), Mission Support of the CSCS (D160B), 9 April 1982

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[44] AFLC Regulation 75-1, Shipment Processing and Documentation, 15 October 1975, updated to 21 December 1977

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[51] AF Manual 177-206, Automated Material System Interfaced with Supply System at Base Level, Users Manual, 1 August 1979, updated to 1 February 1983.

[52] AF Regulation 66-1, Maintenance Management, Volume 3, Squadron Maintenance, 2 January 1980

[53] "Validation of the Algorithm for Base Inspection Costs for the Component Support Cost System (D160B)," Information Spectrum, Inc., Report No. V-83-31859-04, 15 August 1983

MEMORANDA OF AGREEMENT
FOR SYSTEM INTERFACES

Ref. No.	Memorandum No.	Date
[6.1]	D002A/M024B/D160B-A	9 Jun 1980
[6.2]	D002A/M024B/D160B-B	9 Jun 1980
[6.3]	D024A/D160B-A	30 Jun 1980
[6.4]	D033./ARC/D160B	14 Jun 1980
[6.5]	D042A/DNB/D160B	4 Nov 1983
[6.6]	D046/M024/D160B	9 Apr 1981
[6.7]	D046/D160B	23 Jun 1982
[6.8]	D056A/BDN/D160B-A	23 Jan 1981
[6.9]	D056A/D160B-C	13 Oct 1981
[6.10]	D056A/D160B-D	29 Jan 1981
[6.11]	D056A F005	25 Apr 1979
[6.12]	D056B/BDN/D160B-A	22 Dec 1980
[6.13]	D056C/D160B-A	4 Mar 1981
[6.14]	D071/D160B	17 Jun 1982
[6.15]	D143B/D002A 9159	3 Aug 1979
[6.16]	D143F/ARC/D160B-A	5 Feb 1981
[6.17]	D160/D160B	11 Jun 1982
[6.18]	G004L/M024B/D160B-A	30 May 1980
[6.19]	G004L/M024B/D160B-B	30 May 1980
[6.20]	G004L/M024B/D160B-C	5 Nov 1981
[6.21]	G019F/D160B	8 Sep 1982
[6.22]	G033B/D160B	12 Jul 1982
[6.23]	G072D/BDN/D160B-A	19 Apr 1982

MEMORANDA OF AGREEMENT
FOR SYSTEM INTERFACES (Continued)

Ref. No.	Memorandum No.	Date
[6.24]	H036B/RC/D160B-A	10 Feb 1981
[6.25]	H069R/M024B/D160B-B	19 Jan 1981
[6.26]	0013/BDN/D160B	22 Jul 1982

ATTACHMENT 1

TRANSACTION HISTORY
RECORD SELECTION CRITERIA

(Copied from Reference [24])

TRANSACTION HISTORY RECORD SELECTION CRITERIA
(Program 990/D17)

1. Step 1: Select transaction history records with "Type OCCR Code" equal to 7, 8, and. Exclude the transaction history records with type OCCR Code 7, 8, and 9 for the following:

a. Type account code K (ammunition)

b. Budget Code G (fuels)

c. Budget Code I (AEIC)

d. DIC/TRIC:

(1) A2(X) Redistribution Order
(2) A4(X) Referral Order
(3) FK(X) Billings Transactions
(4) FM(X) File Maintenance
(5) FT(X) Materiel Return Transactions
(6) SH(X) Non-Directed Shipment
(7) SM(X) IMR Monetary Adjustments
(8) REC with FIA Code Unequal to "440" (Local Manufacture Receipt)
(9) TIN if Credit Code Equal to "F"

2. Step 2: Further select the transaction history records from step 1 to exclude all transaction history records with FIA codes unequal to the following:

a. Issue FIA Codes - 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 330, 331*, 334, 572

* NOTE: Exclude if budget code unequal "1".

b. Turn-in FIA Codes - 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 440, 441*, 664, 681

* NOTE: Exclude if budget code Unequal "1".

3. Step 3: Further select the transaction history records from step 2 for "SRD" equal to:

SM(X)	1 (XX)
SP(X)	2 (XX)
A (XX)	3 (XX)
B (XX)	4 (XX)
C (XX)	5 (XX)
E (XX)	6 (XX)
F (XX)	7 (XX)
J (XX)	8 (XX)
K (XX)	Q (XX)
X (XX)	U (XX)

Attachment 2: Proposed DAR Entries Supporting Correction of Programming Error in D002A

Requirement:

Supply Consumable Material data is provided to the Component Support Cost System (DSD D160B) by D002A in accordance with procedures described in AFM 177-206, Chapter 60. Personnel of the Air Force Data Systems Design Center have identified (1) a programming error which they describe as follows:

> "Local manufacture transactions (TRIC "REC" with FIA 440) are assumed to be issues by the program instead of a turn-in. The end result is a local manufacturer receipt and an issue can cause identical contributions to the Daily CSCS Record (1CM)."

Impact Statement

Failure to implement means that CSCS base material costs will be in error by twice the value of local manufacture receipts.

Justification Benefits/Cost Savings

Required to correct an acknowledged programming error. Although the impact of the error on the CSCS as a whole is a small, material cost outputs are now wrong for any Work Unit Code with any significant amount of local manufacture receipts.

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(1) Letter from Chief, Material Systems Division, Directorate of Comptroller Systems, Air Force Data Systems Design Center, to HQ AFLC/MM (VAMOSC), dated 15 September 1983. Subject: D002A, Daily Consumable Material Cost Data Interface with D160B, Component Support Cost System (CSCS) (Your ltr, 15 Aug 83)."

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	8. CONTRACT OR GRANT NUMBER(s) F33600-82-C-0543
	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
	12. REPORT DATE December 1983
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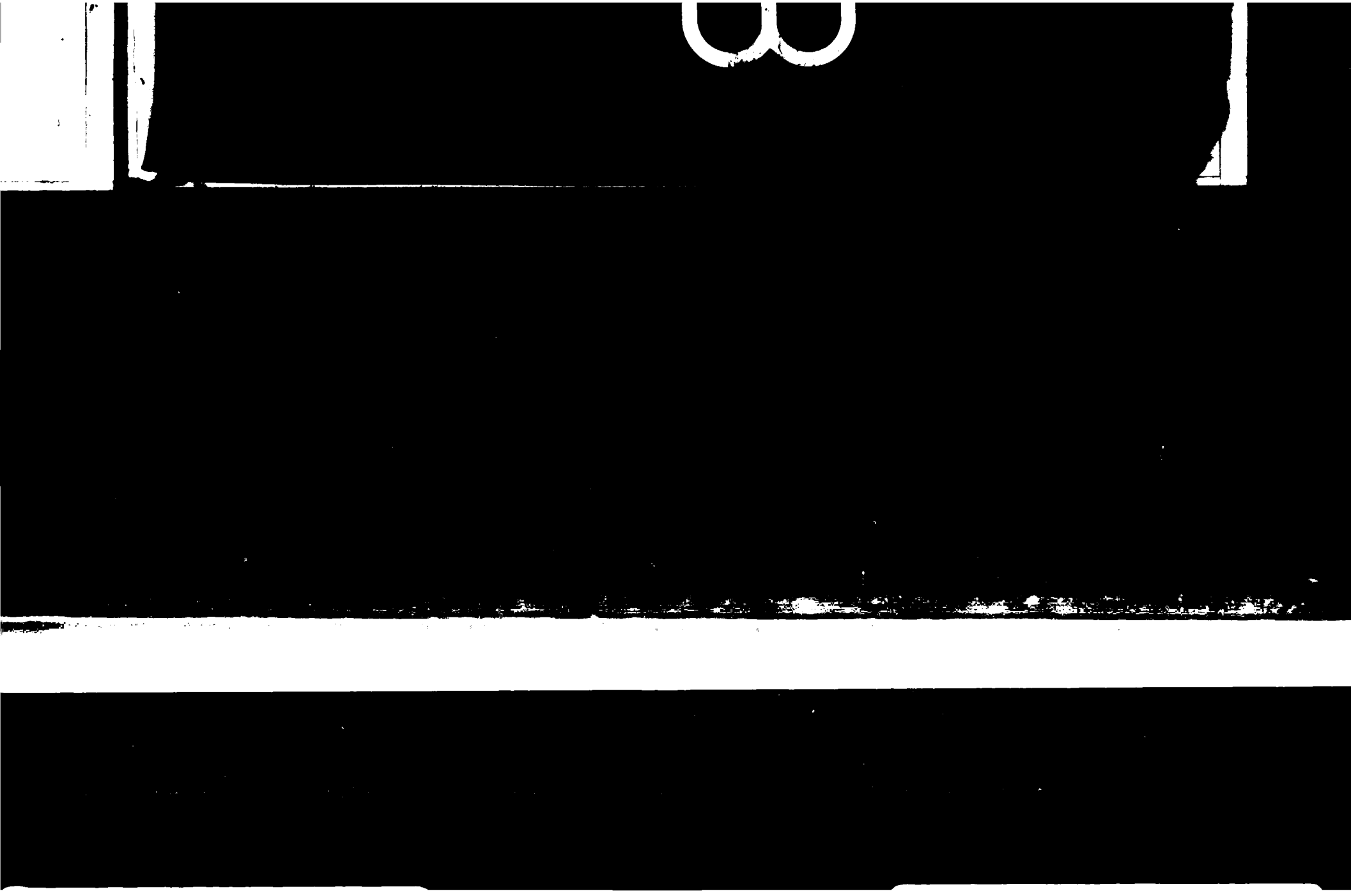

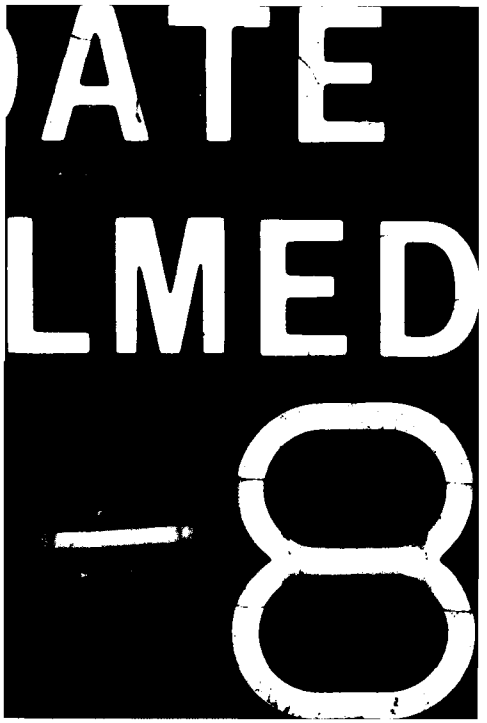
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